



Energy 101

Presented By: Rick Rumsey, P.E.

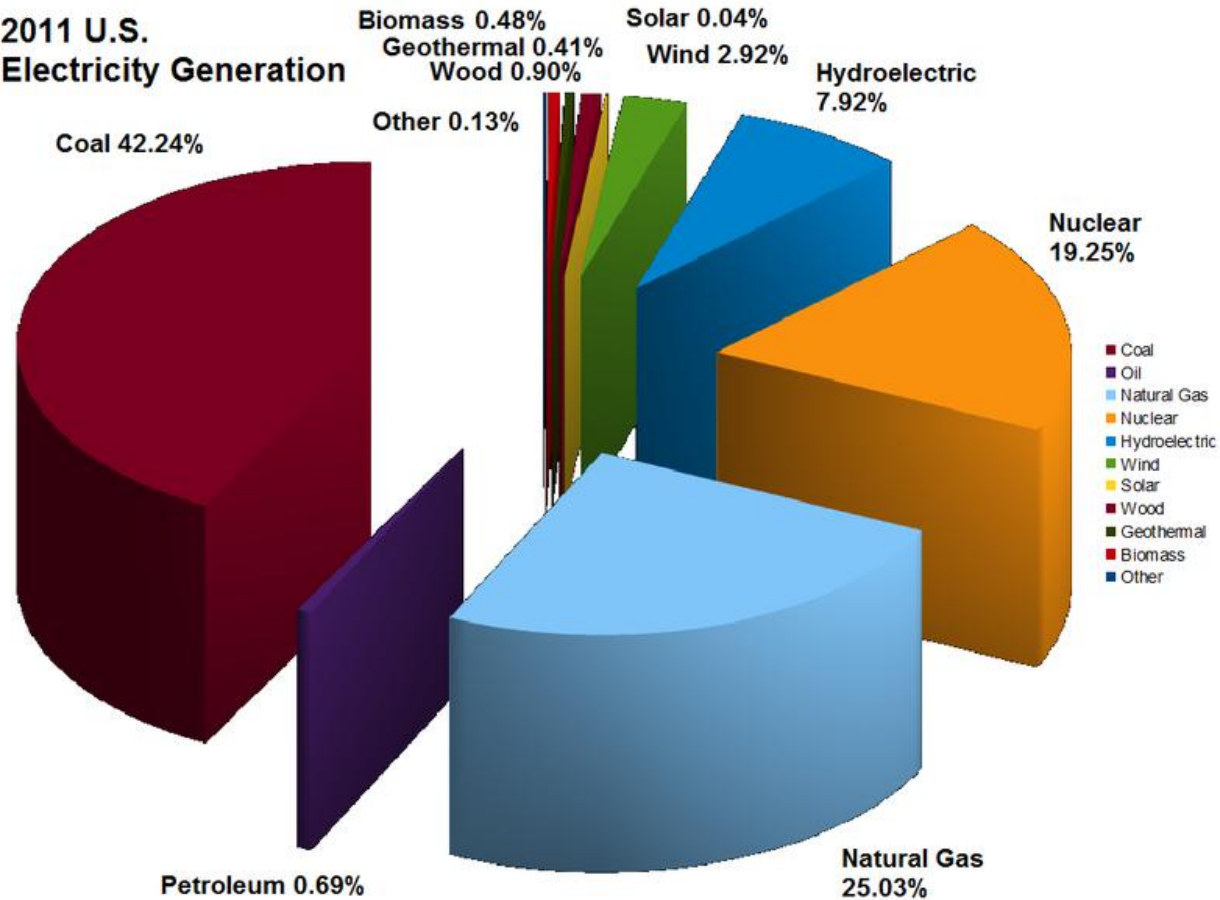
Most Common Types of Energy Used on the Farm

- Electricity
- Diesel Fuel
- Propane
- Natural Gas



How Electricity is made?

2011 U.S.
Electricity Generation



Power Generated by Steam

2011

Coal

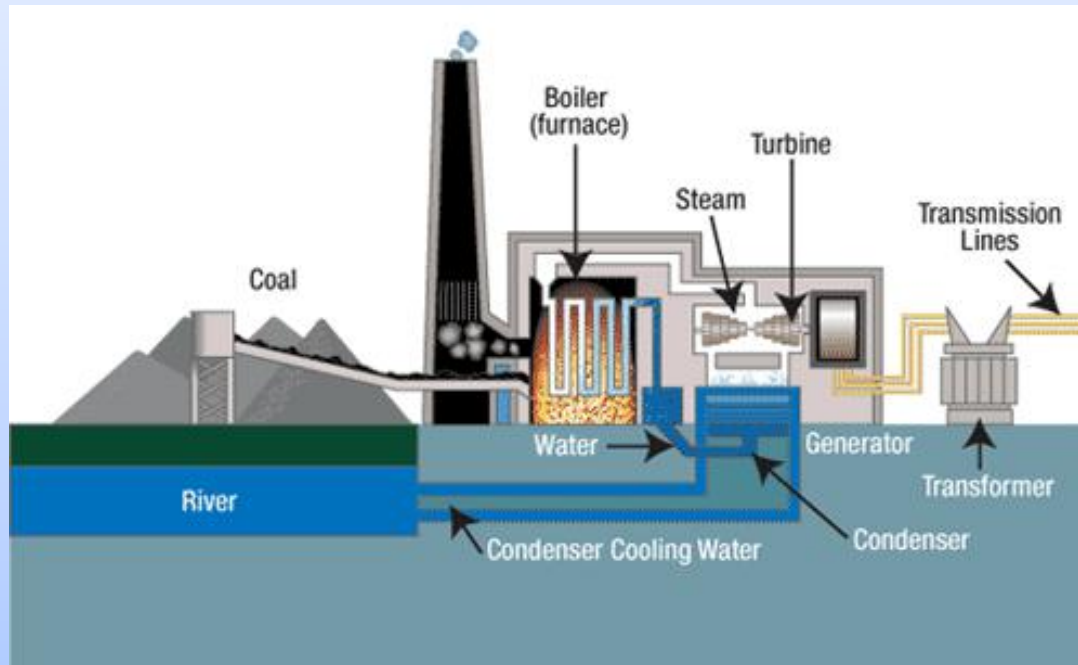
– 42.24%

Natural Gas

– 23.03%

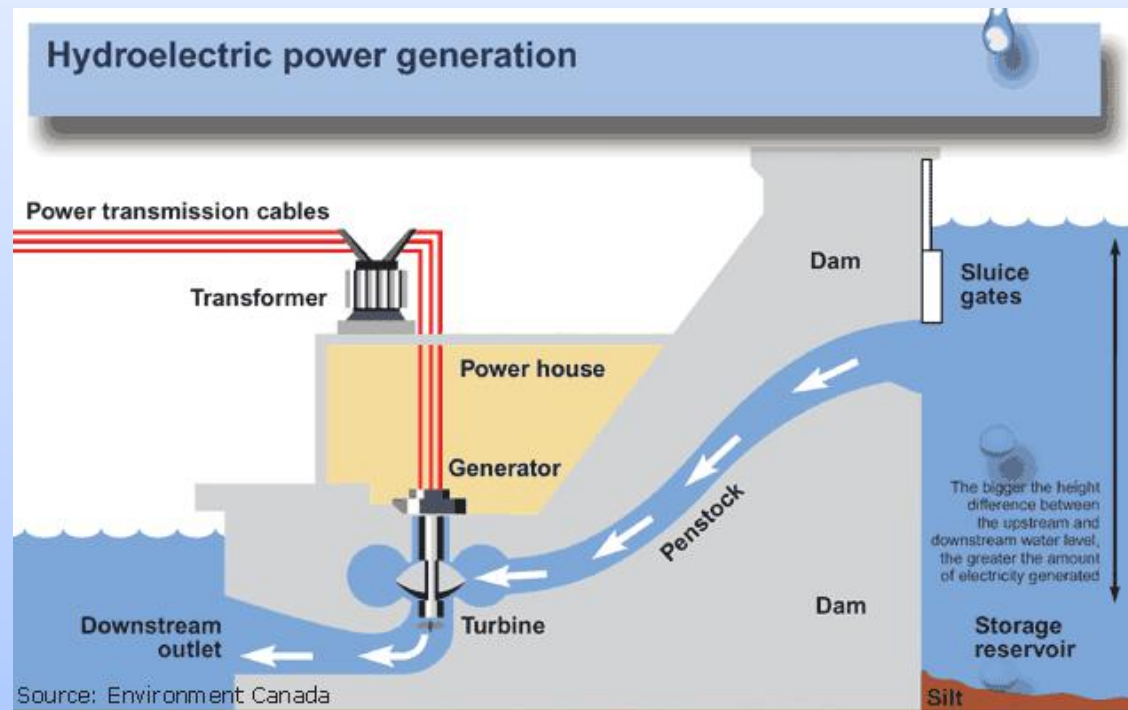
Nuclear

– 19.25%



Hydroelectric Dams

2011
- 7.92%



Wind Power

2011
– 2.92%



Cost to Produce Electricity

| Total | | | | |
|-------|---------|--------------|----------------|-----------------------------|
| Year | Nuclear | Fossil Steam | Hydro-electric | Gas Turbine and Small Scale |
| 2001 | 18.13 | 23.23 | 7.16 | 50.53 |
| 2002 | 18.65 | 21.36 | 6.33 | 37.47 |
| 2003 | 18.95 | 22.75 | 5.79 | 49.66 |
| 2004 | 18.93 | 24.31 | 6.60 | 51.59 |
| 2005 | 18.15 | 27.88 | 6.68 | 61.10 |
| 2006 | 19.57 | 29.85 | 6.46 | 59.56 |
| 2007 | 20.32 | 30.88 | 9.32 | 64.43 |
| 2008 | 21.37 | 35.75 | 9.67 | 70.72 |
| 2009 | 21.69 | 40.48 | 8.38 | 57.55 |
| 2010 | 23.98 | 35.76 | 9.15 | 48.74 |
| 2011 | 24.70 | 35.09 | 8.88 | 44.54 |

Hydroelectric category consists of both conventional hydroelectric and pumped storage.

Gas Turbine and Small Scale category consists of gas turbine, internal combustion, photovoltaic, and wind plants.

Notes: Expenses are average expenses weighted by net generation. A mill is a monetary cost and billing unit equal to 1/1000 of the U.S. dollar (equivalent to 1/10 of one cent).

Total may not equal sum of components due to independent rounding.

Sources: Federal Energy Regulatory Commission, FERC Form 1, "Annual Report of Major Electric Utilities, Licensees and Others via Ventyx Global Energy Velocity Suite.

How Electricity is Measured

- Measured in kW or 1,000 Watts
- Kilowatt hour (kWh)
 - Use 1 kW for one hour.



How Fuels are made?

- Diesel Fuel
- Natural Gas
- Propane
 - All are extracted from the earth and refined.



What Fuel is Most Used on the Farm?

- Diesel Fuel



How Fuel Energy Content is Measured

- British Thermal Unit

- BTU

- Amount of energy needed to heat one pound of water by one degree Fahrenheit.

- MMBTU is million BTUs

- Really BTU/h (Power)

- 1 MMBTU is 293 kWh

Example Conversion:

$$\frac{100,000 \text{ kWh}}{293 \text{ kWh/MMBTU}} = 341.3 \text{ MMBTU}$$

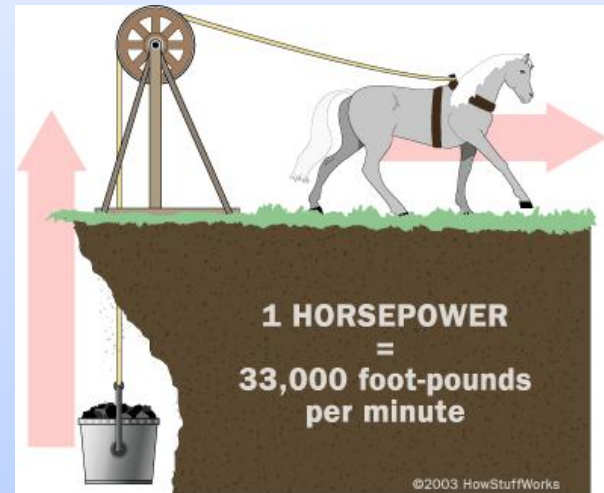


Energy Content of Different Fuels

- Gasoline – 116,090 BTU/gal
- Diesel (No. 2) – 128,450 BTU/gal
- Biodiesel – 119,550 BTU/gal
- Propane – 84,950 BTU/gal
- Compressed Natural Gas (CNG) – 20,268 BTU/lb
- Liquefied Natural Gas (LNG) – 74,720 BTU/gal
- Electricity – 3,414 BTU/kWh

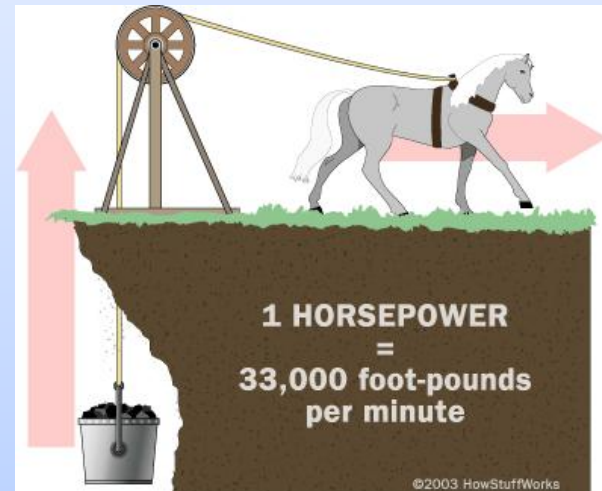
What is Horsepower?

- 1 horsepower = moving 330 lbs, 100 feet in 1 minute.
- 1 hp = 0.746 kW
- Water Horsepower
- $WHP = TDH * Flow / 3,960$
- $HPE = WHP / (Pump\ Eff. * Motor\ Eff.)$



Tractor Horsepower

- Tractor horsepower ratings are based on max observed PTO horsepower
- Drawbar horsepower
 - 85% of PTO HP on concrete
 - 62.5% on firm soil
 - 55% on tilled soil
 - 47.5% on loose soil



COMET Energy Tool

<http://www.comet2.colostate.edu/>

What is the Biggest Energy Cost on the Farm?

- Diesel Fuel

or

- Electricity



Why Energy Efficiency?

- Saves Money!!!!!!
- Good for the environment!!
- Why are utilities willing to pay for energy efficiency?
 - Least cost resource
 - Government mandate
 - Makes customers happy
- Why is the USDA concerned about energy efficiency?
 - Conservation!!!!
 - NRCS – Natural Resources Conservation Service

Questions????

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